

CLAIMS

1. An electronic pen comprising a body (12), a pen
5 stem (14) slidingly received in said body (12), and a
sensor arrangement (16) whose electrical resistance
varies in accordance with the amount of force applied
to the sensor arrangement (16) via the pen stem (14),
characterised in that the sensor arrangement
10 (16) is designed as a modular unit with an electrode ele-
ment (41) and a closure element (46) that are mutually
arranged in an essentially electrically insulated initial
position, that one of said elements (41; 46) is arranged
to receive said force from the pen stem (14) and thereby
15 be urged to an activated position in electrical contact
with the other element (46; 41), and that, on relaxation
of said force, the force-receiving element (41; 46) is
arranged to automatically spring from the activated posi-
tion back to the initial position.
- 20 2. The electronic pen as set forth in claim 1,
wherein the electrode element (41) is integrated with
the closure element (46).
3. The electronic pen as set forth in claim 1 or 2,
wherein the force-receiving element (41; 46) is canti-
25 levered in said sensor arrangement (16).
4. The electronic pen as set forth in claim 1, 2 or
3, wherein said electrode element (41) and said closure
element (46) are essentially planar.
5. The electronic pen as set forth in any one of
30 the preceding claims, wherein the sensor arrangement (16)
comprises a sheet substrate (36) with a closure area and
an electrode area formed thereon, the substrate (36)
being bent such that the closure area and the electrode
area form said closure element (46) and said electrode
35 element (41), respectively.

6. The electronic pen as set forth in any one of the preceding claims, wherein the closure element (46) is the force-receiving element.
7. The electronic pen as set forth in any one of the preceding claims, wherein the electrode element (41) comprises two electrically separate conductor paths (38, 40) forming an active surface (42) for cooperation with the closure element (46).
8. The electronic pen as set forth in claim 7, wherein at least a central surface portion of the active surface (42) has an essentially uniform distribution of said conductor paths (38, 40).
9. The electronic pen as set forth in claim 7 or 8, wherein the sensor arrangement comprises a spacer (52) of electrically insulating material which, in said activated position, is arranged to at least partly encompass the active surface (42).
10. The electronic pen as set forth in any one of the preceding claims, wherein the closure element (46) includes a semiconducting material.
11. The electronic pen as set forth in any one of the preceding claims, wherein the closure element (46) includes a pressure-sensitive material.
12. The electronic pen as set forth in any one of the preceding claims, further comprising a force-transmitting element (34) which is attached to one end of the pen stem (14) and has a rounded abutment surface (82) for cooperation with the force-receiving element (41; 46).
13. The electronic pen as set forth in claim 12, wherein the force-transmitting element (34) is made of an elastic material.
14. The electronic pen as set forth in claim 12 or 13, wherein the force-transmitting element (34) defines a blind hole (84) which is adapted to receive said one end of the pen stem (14) and whose peripheral wall has at least one longitudinal groove (88).

15. The electronic pen as set forth in claim 14,
wherein the force-transmitting element (34) comprises
an insert (86) which is arranged over the end wall of
the blind hole (84) and is made of a hard and durable
5 material.

16. The electronic pen as set forth in claim 15,
wherein the insert (86) on its surface facing the blind
hole (84) is provided with at least one depression (90)
that extends from a central portion of said surface and
10 connects to said longitudinal groove (88).

17. The electronic pen as set forth in any one of
claims 12-16, further comprising an elongate holder (18)
defining a first and a second chamber (54, 56), wherein
the sensor arrangement (16) is mounted in the first cham-
15 ber (54) and the force-transmitting element (34) is slid-
ingly received in the second chamber (56) for longitudi-
nal movement into the first chamber (54) against the
spring action of the force-receiving element (41; 46).

18. The electronic pen as set forth in claim 17,
20 wherein the holder (18) comprises a lug portion (60)
which is formed between the first and second chambers
(54, 56) to limit the movement of the force-receiving
element (41; 46) away from the other element (46; 41).

19. The electronic pen as set forth in claim 17 or
25 18, wherein the holder (18) defines a mounting opening
(68) which at least partly is defined by flexing sidewall
portions (64) that allow insertion of the force-transmit-
ting element (34) into the second chamber (56) and limit
its lateral movement therein.

30 20. The electronic pen as set forth in any one of
claims 17-19, wherein the holder (18) comprises a guiding
element (80) for cooperation with a complementary guiding
element on the body (12).

35 21. The electronic pen as set forth in any one of
claims 17-20, wherein the electrode and closure elements
(41, 46) are interconnected by means of a web portion
(48), and wherein the web portion (48) is received in a

guiding opening (62) defined in a sidewall portion of the first chamber (54).

22. The electronic pen as set forth in any one of claims 17-21, wherein a contacting opening is defined in 5 a sidewall portion of the first chamber (54), and wherein the electrode element (41) extends from the first chamber (54), through the contacting opening, into abutment against a contacting surface which is formed on the holder (18) for contacting a circuit board (20) arranged 10 in the pen.

23. The electronic pen as set forth in claims 21 and 22, wherein the contacting opening is arranged opposite to the guiding opening (62).

24. The electronic pen as set forth in any one of 15 the preceding claims, wherein the electrode element (41) comprises a layer of graphite.

25. A control device for installation in an electronic pen (10) provided with a pen stem (14) and an associated force sensor (16), comprising a comparator (108) 20 which is adapted to receive an analog measuring signal from the force sensor (16), to compare the analog measuring signal with a fixed reference signal and, based on the comparison, to issue a digital output signal; a converter (106) which is adapted to receive the analog measuring signal and to convert this into a sequence of 25 digital force values; and a processor (102) which is electrically connected to the comparator (108) and the converter (106) and which is adapted to selectively activate the converter (106), based on the digital output signal from the comparator (108).

30 26. The control device as set forth in claim 25, wherein the processor (102), before activating the converter (106), is adapted to switch from a waiting state with low internal clock frequency to an active state with 35 high internal clock frequency.

27. The control device as set forth in claim 26, wherein the processor (102), in its active state, is

adapted to at least intermittently activate a position sensor (30) for determination of the position of the pen (10) on a base.

28. The control device as set forth in claim 27,
5 wherein the processor (102) is adapted to associate each position with a force value included in said sequence.

29. The control device as set forth in any one of claims 26-28, wherein said processor (102), at least in its waiting state, is adapted to generate said reference
10 signal.

30. The control device as set forth in any one of claims 26-29, wherein the processor (102) is adapted to receive the digital output signal of the comparator (108) on an interrupt port, at least during the waiting state.

15 31. The control device as set forth in any one of claims 25-30, wherein the comparator (108) and the converter (106) are realised as a first and a second operation mode, respectively, of a programmable analog-to-digital converter.

20 32. A method of controlling an electronic pen (10) based on an analog measuring signal from a force sensor (16) associated with a pen stem (14) of the pen (10), comprising the steps of comparing the analog measuring signal with a fixed reference signal, and selectively, 25 based on the comparison, initiating an analog-to-digital converter to convert the analog measuring signal to a sequence of digital force values.

33. The method as set forth in claim 32, wherein the force sensor (16) has non-linear force characteristics
30 over an extensive force range, comprising the step of controlling, based on the size of the analog measuring signal, the conversion to one of at least two given conversion ranges which each correspond to a subrange of said force range.

35 34. The method as set forth in claim 33, wherein the step of controlling the conversion comprises automatically shifting the analog-to-digital converter between at

least two given voltage ranges which each correspond to a subrange of said force range when the analog measuring signal reaches given switch points.

35. The method as set forth in claim 33, wherein the
5 measuring signal is generated as a potential difference
over the force sensor (16) which is driven by a constant
current generator (100), and wherein the step of control-
ling the conversion comprises automatically switching,
once the analog measuring signal reaches given switch
10 points, the constant current generator (100) between at
least two currents, which each result in analog measuring
signals, that correspond to a given subrange of said
force range, falling within the voltage range of the
analog-to-digital converter.
- 15 36. The method as set forth in claim 35, wherein
said at least two given currents are selected so that
the analog measuring signal in each switch point after
switching of the constant current generator (100) is
different from any other switch point.